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Serum creatinine concentrations were studied in 52 healthy, full-term infants (29 males and 23 females) during the first five days of life. At birth, mean serum creatinine concentration was 0.76 ± 0.13 mg/dL. At 6 hours of life, values increased to 0.97 ± 0.11 mg/dL ($P < 0.001$) and remained elevated for 24 hours. Values then returned to baseline so that serum creatinine concentrations were 0.81 ± 0.15 mg/dL at 48 hours and 0.61 ± 0.15 mg/dL at 3 to 5 days of age. At birth, serum creatinine concentrations were higher in males than in females (0.80 ± 0.13 versus 0.71 ± 0.11 mg/dL, respectively; $P < 0.009$). However, the increases in serum creatinine concentration observed after birth were similar in both sexes. This is the first report of a prospective longitudinal study of serum creatinine concentrations between birth and 3 to 5 days of age in a Hispanic population. In addition, data were analyzed by sex. The results are a useful reference for normal serum creatinine concentrations in early life. (Henry Ford Hosp Med J 1988;36:193-4)

Clinical renal failure in the newborn is often subtle and difficult to recognize (1,2). Since most methods for precise estimation of renal function are too cumbersome for routine clinical use (3), serum creatinine concentrations are frequently used as an indicator of renal function. Relatively few data defining serum creatinine concentrations in normal newborns are available (4-10). Most data relate to heterogeneous populations or include risk factors which may alter renal function (4-9). We report the results of a study of serum creatinine concentrations in a cohort of healthy Hispanic newborns between birth and the fifth day of life and the differences observed between males and females.

Patients and Methods

Infants born at the Cayetano Heredia University Hospital from March to May 1986 were prospectively evaluated with their parents' consent. The study was approved by the Department of Pediatrics of the Cayetano Heredia University. The following criteria were required for inclusion: 1) a healthy mother, 2) normal pregnancy and labor, 3) full-term vaginal delivery (11), 4) weight for gestational age between the 10th and 90th percentile (12), 5) no evidence of fetal distress, and 6) no postnatal complications. A total of 52 consecutive infants (29 males and 23 females) fulfilling the criteria were entered into the study.

Cord blood was obtained at birth, and successive samples were obtained by venipuncture at 6, 24, and 48 hours, with a last sample obtained between the third and fifth day of life. Maternal samples were obtained immediately after birth. Serum creatinine concentrations were measured spectrophotometrically using the kinetic method by Bartels and Bohmer (13) as modified by Boehringer Mannheim (Boehringer Mannheim GmbH, West Germany). Briefly, 200 μL of serum were added to 2 mL of reagent (a 1:1 mixture of 35 mM picric acid and 0.32 N NaOH) at a temperature of 25°C to 30°C, and the optical density was read after 30 and 150 seconds at 490 nm. All samples and standards were analyzed in duplicate. The coefficient of variation in 19 measurements of one sample was 5%. Statistical analysis was done by analysis of variance for assessment of differences between multiple groups and by the Student *t* test for comparisons between two groups. Values are expressed as mean ± SD.

Results

The mean gestational age of the 52 infants studied was 39.3 ± 0.7 weeks, and the mean birthweight was 3,245 ± 278 g. Serum creatinine concentrations are shown in the Figure. Compared to creatinine values in cord blood, serum creatinine concentrations at 6 hours of life showed a 31% increase ($P < 0.001$). No differences were noted between values at 6 and 24 hours. When compared to the 24-hour value, serum creatinine concentrations decreased by 48 hours ($P < 0.001$) and reached a nadir by three to five days postbirth. This pattern was almost universal; the rise at 6 hours and decrease at 48 hours in serum creatinine concentrations were noted in 94% of infants.

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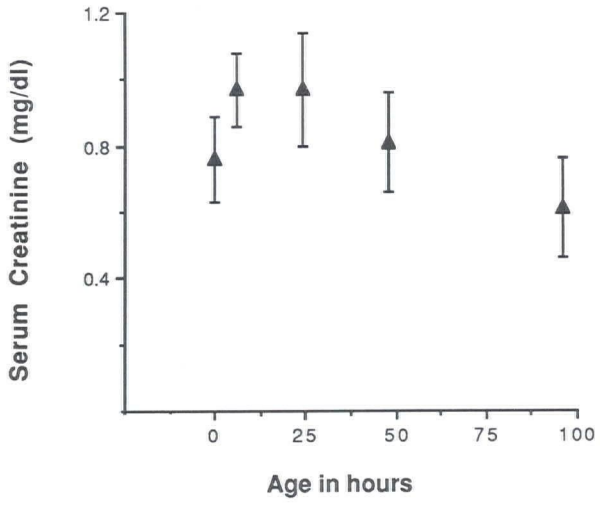

Figure—Serum creatinine concentrations in newborns during the first five days of life. A significant increase in serum creatinine concentrations occurred during the first 24 hours, followed by a return to below baseline values ($F = 37.4$, $P < 0.001$). Data are presented as mean ± SD.

Male infants had greater serum creatinine concentrations at birth than females (Table; $P < 0.009$), although no maternal differences in serum creatinine concentrations were noted at delivery (Table; $P = 0.42$). However, the absolute rise in serum creatinine concentrations was similar in both sexes at 6 hours (males, 0.21 ± 0.14 mg/dL; females, 0.22 ± 0.10 mg/dL). Differences between sexes were not observed at 24 hours or thereafter.

Discussion

Several studies have examined serum creatinine concentrations in the neonatal period (4-10). This is the second report demonstrating that serum creatinine concentrations increase within the first 24 hours after birth (10). This increase is evident as early as six hours after birth. The initial increase in serum creatinine concentration is difficult to explain. A higher placental creatinine clearance when compared to the initial renal creatinine clearance could play a role (6,14-16). In addition, during the first hours of life a significant fluid shift from the vascular compartment results in higher hematocrit and serum protein concentrations. However, such a change could account for an increase in serum creatinine concentration of not more than 16% (17). Our findings are similar to other studies that have shown a fall in serum creatinine concentrations between the first and seventh day of life (4,6-8,10). Changes in renal blood flow, renal vascular resistance, and glomerular determinants of glomerular filtration pressure resulting in increased renal function are the most likely factors responsible for the decrease in serum creatinine concentration during this period.

To our knowledge, this is the first report of higher serum creatinine concentrations in male than in female infants at birth. Interestingly, sex differences are no longer observed at 24 hours or thereafter. This study does not give insight into the reason for sex differences in serum creatinine concentrations at birth.

Table
Gestational Age, Weight at Birth, and Maternal and Newborn Serum Creatinine Concentrations

	Gestational Age (weeks)	Birthweight (g)	Serum Creatinine Concentration (mg/dL) Maternal	Birth	6 hr	24 hr	48 hr	3-5 days
FEMALES								
Mean	39.3	3,208	0.82	0.71	0.92	0.91	0.84	0.62
SD	0.6	255	0.09	0.11	0.07	0.13	0.16	0.20
Number	22	23	22	23	22	18	15	11
MALES								
Mean	39.4	3,275	0.80	0.80	1.01	1.01	0.80	0.61
SD	0.8	296	0.15	0.13	0.11	0.19	0.15	0.08
Number	29	29	21	29	27	23	21	10
P Value	NS	NS	NS	0.009	0.001	0.06	NS	NS

*1 mg/dL = 88.5 μmol/L.

In summary, a rise in serum creatinine concentration is observed as early as six hours after birth in healthy babies. During the first 24 hours of life, male infants have higher serum creatinine concentrations than females. Serum creatinine concentrations are inversely proportional to postnatal age only after the first day of life.

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